



**State & Federal Contractors  
Water Agency**

*1121 L Street, Suite 806, Sacramento, CA 95814*

May 2, 2017

Janis Cooke  
Central Valley Regional Water Quality Control Board  
11020 Sun Center Drive, Suite 200  
Rancho Cordova, CA 95670-6114

RE: Comments on draft report titled, "Delta Nutrients Forms and Ratios Public Workshop: Role of Nutrients in Shifts in Phytoplankton Abundance and Species Composition in the Sacramento-San Joaquin Delta"

Dear Ms. Cooke,

The State and Federal Contractors Water Agency (SFCWA) appreciates the opportunity to review and comment on the subject draft report. The report by the science review panel is to be a review of the pertinent scientific literature, and evaluate the various hypotheses that have been put forth regarding nutrient dynamics in the Delta. The review panel presided over a 2-day workshop held to present a number of studies in November 2016 titled, "Role of Nutrients in Shifts in Phytoplankton Abundance and Species Composition in the Sacramento-San Joaquin Delta" (Nutrients Workshop). Specifically, the review panel was charged with understanding the role of different experimental conditions in the results and interpretation of Ammonium Paradox and the ecological stoichiometry hypotheses; what studies would test these hypotheses; what factors should be considered in the experimental design of such studies; what monitoring, studies, and modeling are recommended to understand nutrients and the ecological response in the Delta; what are the potential outcomes of potential future management actions; and what can be the anticipated responses to changes in nutrient loads, based on other estuaries.

SFCWA has funded much research in the last few years by a number of different research groups to help understand the role of nutrient dynamics of the Delta ecosystem, and potential impacts on water supply as well as on food webs and fish. As part of that effort, SFCWA has funded research by Dr. Pat Glibert, Dr. Richard Dugdale, Dr. Frances Wilkerson, and Dr. Alex Parker. Unfortunately, these researchers could not participate in the Nutrients Workshop. We have retained these researchers and requested that they review the draft report to: 1) Make sure that all the pertinent studies are included in the review and the work is accurately portrayed, and 2) Provide comments on the nutrient hypotheses, what the outstanding issues/uncertainties are, and recommendations for resolving. These researchers' response to the review panel's report will be sent to you separately.

SFCWA has identified several overarching concerns with the draft report.

### Need to Address the Panel Charge

In Section II of the report addressing the Panel's charge, the Panel indicates that it decided to not address the ecological stoichiometry issue because it is a secondary topic dependent on the ammonium paradox conceptual model, and is moot with the broadened research approach the Panel is recommending. SFCWA disagrees with this statement in the report, and requests that the Panel address charge questions related to ecological stoichiometry and consider the Glibert 2015 chapter in the Suisun Synthesis II report, which is provided in the Panel Review Materials. SFCWA believes Panel consideration of ecological stoichiometry fits within the Panel's approach to recommend broadened nutrient and phytoplankton investigations in the Delta.

### Need to Address Complexity of Delta

SFCWA is also concerned that the report does not address the complexity of the Delta and the nutrient and phytoplankton composition for different regions of the Delta. Many statements in the report over generalize conditions in the Delta and are not helpful to inform a Delta nutrient research program. SFCWA requests that the Panel consider the complexity of the Delta in refining the report recommendations.

### Need to Address Outcomes of Future Management Strategies

Section IV of the report addresses outcomes of future management strategies in the Delta. The Panel chose to focus on climate change in this section. While considering the potential effects of climate change is important, it is not the only issue that should be addressed in this section. SFCWA requests that the Panel focus this section on needed monitoring and studies to evaluate the outcomes of management actions to reduce nutrient loading to the Delta.

Most important going forward is the development of the recommended studies to conduct in the future to reconcile the various hypotheses on nutrient dynamics, and to assess the impacts on the Delta ecosystem and nutrient dynamics from planned major changes in nutrients in the near future. We recommend the following:

1. We agree with the review panel's recommendation for future studies to include all nutrients and their proportions, including ammonium (i.e., we recommend studies on ecological stoichiometry) as a framework for understanding the broader role of nutrients in the Delta. Consideration of Total Nitrogen is not a sufficient parameter to understand or manage nutrients in the Delta.
2. We recommend continued study of the effects of ammonium. There is a need for careful, properly conducted experiments on this form of N. The physiological basis for rapid nitrate uptake needs to be studied using appropriate experimental design and implementation (e.g. measuring enzymatic responses and other appropriate physiological responses).
3. We recommend that in the interpretation of ammonium and nitrate relationships, not only is prior light history considered in interpretation of field and laboratory results, but prior N history is also taken into consideration as a critical component of physiological history.
4. We also agree that more work is needed on development of models, especially biogeochemical models that integrate physical factors (flow/retention time, turbidity, light, temperature), nutrient dynamics, biological interactions (e.g. grazers, macrophytes), and the biological responses in the food web. In particular, reaction rates of nutrient processes need to be better understood and quantified under various conditions encountered in the Delta (shallow water habitats, benthic and pelagic zones of the Delta).

5. We recommend future studies focus on the role of nutrients and their relationship to primary productivity and food limitations for important fisheries resources in parts of the Delta. Such studies are especially important with future decreases in nitrogen loads.
6. We recommend future studies focus on the role of nutrients, especially that of nutrient forms and ratios, in fueling the spread of nuisance macrophytes such as *Egeria densa* and *Eichhornia crassipes*. Changes in their abundance is expected.
7. We recommend future studies also include nutrient dynamics in food webs in floodplains and wetlands. This is especially important as efforts are underway to restore thousands of acres of floodplain and wetland habitats. Such studies must include benthic as well as water column studies to fully understand nutrient dynamics.
8. We recommend that future studies focus on the impact of major management actions, such as the Sacramento Regional County Sanitation District's wastewater treatment plant upgrade (EchoWater), on the Delta ecosystem. Such studies should be implemented before the implementation of the upgrade to allow for effects to be fully resolved. It has been hypothesized that EchoWater will have a favorable outcome on the Delta ecosystem, and include the following:
  - a) There should a proportional increase in the abundance of diatoms because of the importance of NO<sub>3</sub> in the nutrition of diatoms;
  - b) There should be a proportional decrease in cyanobacterial blooms in the upper Delta. This is because cyanobacteria such as *Microcystis* obtain a proportionately greater amount of their N as NH<sub>4</sub> than many other phytoplankton (such as diatoms), and the reduction in total load should reduce biomass production accordingly;
  - c) With an increase in diatoms in relation to other types of phytoplankton, the food web should respond favorably, with shifts in zooplankton, increases in endangered fish, and positive responses in other members of the upper food web. Biomass of invasive species, such as *Potamocorbula amurensis* should decrease;
  - d) Macrophyte production should be reduced as the total N will reduce the total amount of biomass that can be supported.

Thank you for the opportunity to comment on this report. We would welcome further discussions with you regarding investigations of nutrient dynamics and their impact on the Delta ecosystem and water supply.

Sincerely,



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Laura Valoppi  
Science Manager